Date:- 25/05/2017

SE MECHATRONICS / SEM-IV / CBSGS /

Q.P. Code :09557

[Time: 3Hours] **[Marks:80]**

Please check whether you have got the right question paper.

N.B:
1. Question No.1 is compulsory.
2. Attempt any three questions from question No.2 to 6
3. Use illustrative diagrams whenever required.

Q.1

a) State and explain **05**
   i) Pascal Law
   ii) Hydrostatic Law.

b) Explain the terms: **05**
   i) Path lines
   ii) Streak line
   iii) Stream filament
   iv) Stream tube.

c) What are different law on which model are designed for dynamic similarity? Where they are used? **05**

d) What is draft tube? Describe the with neat sketches different types of draft tubes. **05**

Q.2

a) Define Cavitation's. What are the effects of cavitation's? Give necessary precaution against the Cavitation's **06**

b) Derive Euler equation of motion along a streamline for the ideal fluid stating clearly the assumptions. Explain how this s integrated to get Bernoulli's equation along a stream-line. **10**

c) Prove that Compressibility for perfect gas under going isothermal Compression is 1/p while for perfect gas undergoing isentropic compression is 1/wp. **04**

Q.3

a) Prove that the Maximum velocity in a circular pipe for viscous flow is equal to two times the average velocity of flow. **08**

b) What is priming of centrifugal of Centrifugal pump? Why is it necessary? **04**

c) A reaction turbine works at 500 r.p.m. under a head of 125 meters. Its diameter at inlet is 125 cm and the flow area is 0.5 m^2. The angle made by absolute and relative velocity at inlet is 20° and 60° respectively with tangential velocity. Determine: (a) the volume flow rate (b) the power developed and (c) Hydraulic efficiency. Assume whirl at outlet to be zero. **08**

Q.4

a) The pressure difference Δp in a pipe of diameter D and length l due to viscous flow depends on the velocity V, viscosity μ and density ρ. Using Buckingham's π-theorem, obtain an expression forΔp. **12**

b) Derive the darcy-Weisbach equation for the loss of head due to friction in pipes. **08**

[P.T.O]

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Q.5 a) A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000 r.p.m. works against a total head of 40 m. The velocity of flow through the impeller is constant and equal to 2.5 m/s. the vane are set back at an angle of 40° at outlet. If the outer diameter of the impeller is 500 mm and width at outlet is 50 mm, determine: (i) vane angle at inlet, (ii) work done by impeller on water per second, and (iii) Monometric Efficiency. **10**

b) Find the loss of head when a pipe of diameter 200 mm is suddenly enlarged to a diameter of 400 mm. the rate of flow of water through the pipe is 250 litres/s. **04**

c) A pipe (1) 450 mm in diameter branches into two pipes (2) and (3) of diameters 300 mm and 200 mm respectively. If the average velocity in 450 mm diameter pipe is 3 m/s, find: (i) discharge through 450 mm diameter pipe and (ii) velocity in 200 mm diameter pipe if the average velocity in 300 mm pipe is 2.5 m/s. **06**

Q.6 a) The hub diameter of a Kaplan turbine, working under a head of 13 m, is 0.35 times the diameter of runner. The turbine is running at 110 r.p.m. If the vane angle of the extreme edge of the runner at outlet is 16° and flow ratio is 0.6, find: (i) diameter of runner, (ii) diameter of boss, and (iii) Discharge through Runner. The velocity of whirl at outlet is given as Zero. **06**

b) A circular hollow plate having 4.0 m diameter and concentric circular hole 2.0 m, is immersed in water in such way that its greatest and least depth below the free surface are 5 m and 2.0 m respectively. Determine the total pressure on face of the plate and position of center of pressure. **10**

c) A shaft of 0.4 m diameter is rotating inside a journal bearing of diameter 0.4015 m at a speed of 190 r.p.m. The space between shaft and bearing is filled with a lubricating oil of viscosity 6 Poise. The length of bearing is 90mm. Find the power absorbed in lubricating oil. **04**